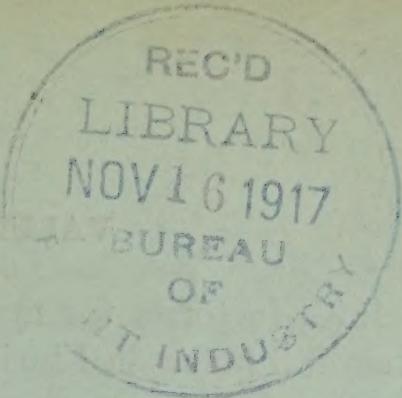


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CASSAVA (*Manihot utilissima*).

Cassava, also called manioc, is cultivated for its starchy roots, which are used extensively for human food, as feed for live stock, and for the manufacture of starch and tapioca. It is a native of Brazil, whence it has been carried to nearly all the warmer parts of the world.

The plant grows as a half-shrubby bush from 4 to 10 feet in height, the branches forking repeatedly. The leaves are on slender petioles, which are from 6 to 12 inches in length, the blade being deeply palmately divided into from 3 to 11 divisions, which are oblanceolate in form, from three-fourths to $1\frac{1}{2}$ inches in width by 5 to 10 inches in length, light green in color, and very smooth, though the divisions vary greatly in size, number, and shape. The flowers are in loose, spreading clusters near the ends of the branch, being about three-eighths of an inch in diameter when open and varying from greenish purple to light greenish yellow in color. The seeds, which are nearly as large as those of the castor bean, are borne in globular pods, ranging from three-fourths to 1 inch in diameter, each pod containing three seeds. The roots, which are the only valuable portions of the plant, grow in clusters from one end of the seed canes planted, single roots being from $1\frac{1}{2}$ to 3 or more inches in diameter and from $1\frac{1}{2}$ to 4 or more feet in length, and usually red or brown on the surface. Clusters of roots ordinarily weigh from 5 to 10 pounds, though they often reach 20 to 30 pounds each.

There are no definite records which indicate when cassava was first cultivated in the United States. It was common in many parts of Florida more than 60 years ago, and during the Civil War was used quite commonly for the production of starch in small quantities for domestic use. Cassava starch, however, does not appear to have become an article of trade until 1896.

VALUE AND USES.

About 1895, factories for making starch from cassava were established at several places in Florida, but the difficulty in securing a sufficient supply of the roots at prices which made the starch profitable caused the enterprise soon to be abandoned; and, so far as can be learned, no cassava starch, flour, or tapioca is now manufactured in the United States, our supplies of these materials being imported from Cuba and South America.

Practically all the cassava now grown in this country is fed to live stock. All kinds of stock eat it with relish, and when used as a part of their ration they thrive much better than when confined to dry food.

The proportion of water in the fresh roots is somewhat larger early in the season than in winter, but averages about 66 per cent. The analysis of fresh roots, based on the average of four analyses made by the Bureau of Chemistry of the United States Department of Agriculture, is approximately as follows:

	Per cent.
Moisture -----	66.00
Ash -----	.71
Protein -----	1.07
Crude fiber -----	1.83
Nitrogen-free extract -----	30.24
Ether extract -----	.15

Cassava roots furnish a feed in which the carbohydrates are largely in excess. Fortunately, however, velvet beans or cowpeas are the cheapest hay feeds which can be grown in the cassava-growing regions, and cottonseed meal is the cheapest grain feed which can be purchased, and all these feeds are unusually rich in protein and deficient in carbohydrates; so that a combination of cassava with either of these makes a perfectly balanced ration which is easily varied to meet the needs of growing animals, of milch cows, or of stock which is being fattened.

CULTIVATION.

The best soil for growing cassava is a light, rich, sandy loam, and many growers prefer that such a soil should be underlain by a hardpan, which will prevent the roots from going too deep into the ground. The soil should be dry rather than wet, and fair yields can be secured from soil too dry for corn and most other crops.

The best crops to precede cassava and to put the soil in good condition for its growth are velvet beans or cowpeas. In the region where cassava can be grown the velvet bean will make a rank growth and mature its seed, and so is generally preferred to the cowpea, though

the latter has the advantage of making its growth in a shorter time and so is commonly used where the land has been occupied with oats or some other crop during the spring and early summer.

The soil is prepared for planting by plowing it broadcast¹ as for any ordinary crop. The marking in one direction may be done with an ordinary corn marker marking three or four rows at once, or by using a small plow. The cross marking, however, should always be done with a plow and the rows opened so deep that the seed canes can be easily covered. When the field is ready for planting the seed canes are cut in pieces from 4 to 6 inches in length, and care should be taken to see that they are alive and in good condition. One can usually tell the difference between live and dead canes by their general appearance, the live canes being plump, with fresh-looking bark, sound pith, and full eyes, while the dead canes usually show their condition by their shrunken appearance, bleached or darkened color, discolored or dried pith, and shrunken eyes. In nearly or quite all cases if the skin near an eye on a live cane is cut with the thumb nail, fresh and slightly milky juice will be seen in the wound, while a similar puncture in a dead cane will remain dry or show only watery, often discolored juice.

The pieces of seed cane are dropped, one or two at each crossrow, and covered with a plow or hoe, as Irish potatoes are covered, the covering being from 2 to 4 inches in depth, the deeper covering being given on the lighter soil. The crop requires no special cultivation beyond that required to keep the ground free from weeds and the surface loose and friable. The surface of the ground should be kept as nearly level as possible, and no hilling up should be done, as many of the roots reach nearly or quite across the spaces between the rows.

HARVESTING.

Digging the roots may begin as early as October, and may then be continued indefinitely when used for feed, though usually they are not used between May and October. If the entire crop is not wanted for use during the winter following its growth, a part of it may be left in the ground for another season, as the roots will continue to grow several years if not disturbed. Roots which have grown two or more seasons often reach an enormous size, sometimes as much as 8 feet in length and forming clusters weighing more than 100 pounds; but they become more hard and woody than at the end of the first season, and so are not as good for feeding as those which have grown only one season. When it is known beforehand that a

¹ "Broadcast" is a term used to distinguish ordinary plowing from a kind of plowing peculiar to cotton raising in the South.

part of the crop is to be kept until the second season it is better to dig alternate rows, so that the plants remaining will be less crowded.

As the roots are of considerable size, often from 3 to 4 feet in length by 2 or 3 inches in diameter, and as they grow in clusters of from 4 to 8 on each stalk, a single cluster often weighing from 20 to 30 pounds, the digging can not be done with a plow, as sweet potatoes are dug, but must be done by hand. The original section of seed cane which was planted does not decay when growth begins, but continues to live and grow through the entire season, the new stalk usually growing from one end and the cluster of roots from the other. The piece of seed cane which was planted thus becomes what is called the "union" between the stalk and roots of the new plant. When the stalks are cut, either for seed canes or to clear the land for digging, a stub 5 or 6 inches high is left, to show the position of the root and to furnish a hold for pulling it from the ground.

Various tools are used in digging, and sometimes, especially when the soil is very light and the root growth is small, the work is done by simply grasping the stub and pulling the roots with the hands. This method answers very well on light soil and when only a few roots are gathered daily, but where the soil is heavier and where any great quantity is to be gathered some simple tool is of great assistance. Some growers use a grubbing hoe, while others use a cant hook, such as is used in handling logs, pushing the hook under the union and then lifting the cluster of roots from the soil. Still others use pinchers, much like large blacksmith pinchers, but with the end of each handle turned into a ring for a handhold.

Under ordinary conditions the roots begin to blacken and decay within three or four days after they are dug, so the common practice is to dig from day to day as they are needed, or at most for not more than a week in advance.

YIELDS.

The yield of cassava is as variable as that of other cultivated crops, its amount depending principally on the vitality of the seed canes planted and the quality of the soil. The character of the season, whether wet or dry, has but little influence, but long seasons give increased returns. On the very light, worn, sandy soils, where no fertilizers are used, the yield may not be more than 2 or $2\frac{1}{2}$ tons per acre, while on reasonably good soils which have been given a moderate amount of fertilizer or on which a crop of velvet beans or cowpeas was grown the previous season a yield of 5 to 7 tons may be expected. Some of the best fields, where the soil is just right and a full stand of plants is secured, make from 10 to 15 tons per acre, but such yields are unusual.

PRESERVING SEED CANES.

One of the most difficult things in growing cassava is to save the seed canes for planting. They are killed by a frost which is severe enough to kill tomato vines. If stored when too immature or kept too dry they are liable to suffer from dry-rot, and if covered too closely or allowed to become thoroughly wet they are almost sure to decay. Only well-matured canes can be kept through the winter, and these should be cut as late in the season as is possible, since the roots are then making their best growth and cease to grow as soon as the canes are cut.

Various methods are followed in storing the canes, though in general they are stored and kept like sweet potatoes. A common method in central Florida is to dig a ditch in well-drained soil about 18 inches in depth, from 3 to 4 feet wide, and as long as may be needed. The canes are set on end in this ditch, packed as closely as possible, and then covered with straw or litter, which is held in place with a little earth. The top covering is left rather thin until cold weather, when more earth is added.

Another method is to build a permanent house, similar to a potato house, with sides about 3 feet in height. The canes are stood on end to fill the house, their tops being well covered with straw and the sides of the house banked with earth.

Numberless variations of these methods are practiced, but all agree in a few essential particulars: The canes must be well matured when stored; they must not be stored while wet; after they are packed in the beds they must be covered lightly at first to permit the escape of surplus moisture; they must be covered more deeply later in the season to exclude cold; and the covering must always be one which will not permit rain to soak through into the bed. Dry-rot and decay are the troubles most to be feared, the former coming from storing immature canes and from heating, while the latter usually follows the presence of too much moisture.

In extreme southern Florida, where frosts are rarer, the canes will often live through the winter when left standing in the open field.

COMPARISON WITH SWEET POTATOES.

The feeding value of cassava is about the same as that of sweet potatoes, and it requires the same type of soil for its cultivation, so the choice between the two crops should be decided largely by the amount of labor required to secure a ton of each ready for feeding. Planters usually estimate the cost of growing cassava to be from \$6.50 to \$7 a ton, or about the same cost per ton as for sweet potatoes; but where the seed canes have to be stored several months potatoes

are much more reliable. The potatoes can all be dug at one time and stored with little danger of loss, while the cassava must remain in the ground until within a few days of the time when it is wanted for use, and if the ground is frozen, even slightly, many of the roots will decay. Cassava is a crop for a warm climate, and one which requires a long season for its maturity.

Although the crop was formerly grown quite commonly as far north as Georgia and as far west as Texas, it has now been almost wholly replaced by sweet potatoes, largely on account of the great uncertainty of being able to preserve the seed canes in good condition through the winter. It is now grown, somewhat extensively, in the southern part of Florida, where it is valued highly; but it has not been found sufficiently reliable to be generally profitable farther north or west.

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Approved:

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Chief of Bureau.

JULY 29, 1916.

